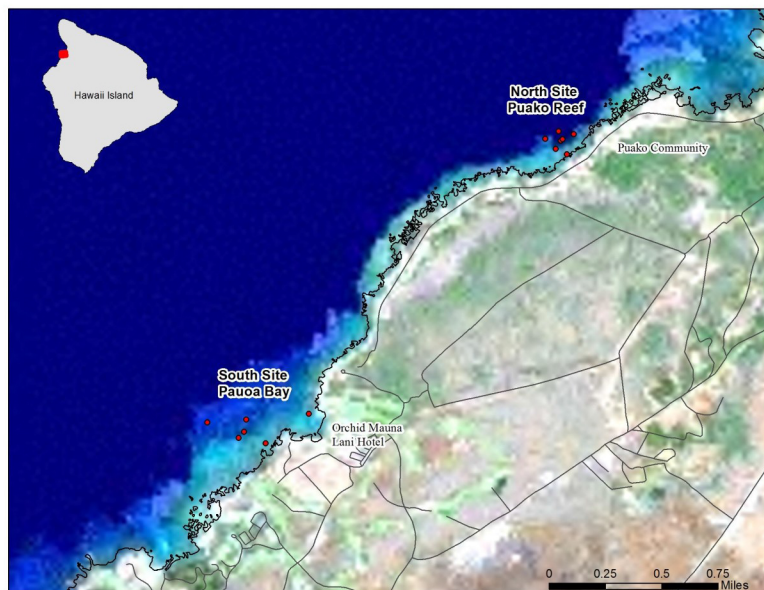




## History of Puako and Pauoa Fisheries Management Areas

The Puako Fishery Management Area (FMA) was established in 1985 by the State of Hawaii. The use of nets, except thrownets, is prohibited within the boundaries of the Puako FMA. Pauoa was designated a Fishery Replenishment Area on December 31, 1999. The collecting of aquarium fishes within the FRA is prohibited. In addition, the area was closed to lay net fishing in 2005. Prior to the establishment of the Puako FMA, a comprehensive quantitative ecosystem analysis was performed from 1979-1981. The original study surveyed six transects at each location (see map); transects were chosen to represent the different coral reef habitats present. During 2007-08, Hawaii Division of Aquatic Resources personnel re-located the twelve transect sites surveyed by the original study, and re-surveyed each of them twelve times. We analyzed these two data sets to look for long-term changes in the abundance of fishes and invertebrates at Puako and Pauoa, and investigated whether differences in management regulations at the two sites resulted in differing marine communities.

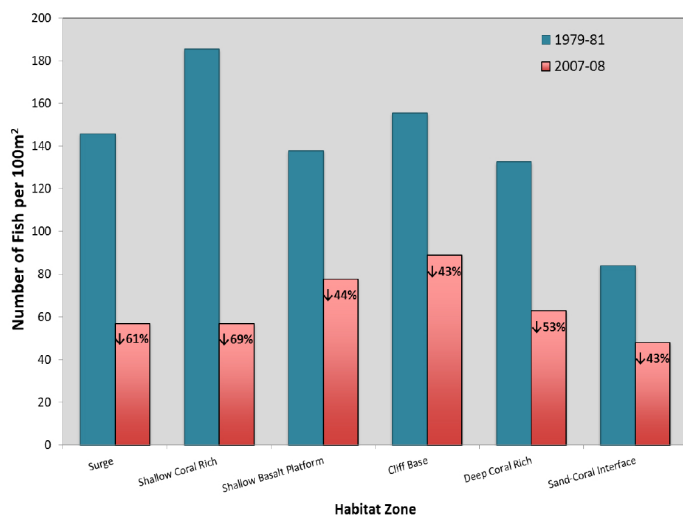


Location of Puako FMA and Pauoa FRA, south Kohala

## The Decline in Abundance of Fishes at Puako

On each of the transects at Puako, total abundance of all species of fishes declined, between 43 and 69%, between the original and subsequent surveys. Of the thirty-five most abundant reef fish species found at Puako in the initial surveys, 31 species declined in abundance, from a 9% decline of the Yellow Tang to a 97% decline for the Achilles Tang. The only fish species of the top 35 that increased in abundance at Puako were two species of small damselfish, the Black Durgon, and the Belted Wrasse.

Puako, South Kohala, Long Term Study  
Total Fish Abundance

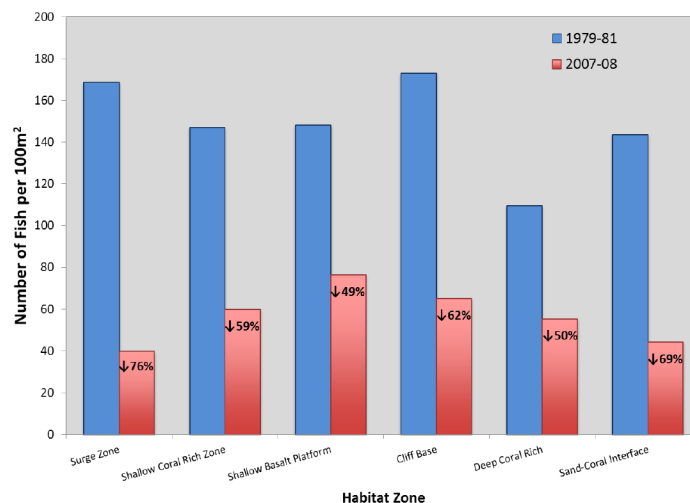


Total abundance of fishes per hundred meters squared in six different habitat types at Puako. Blue bars represent data from the original study, red bars represent the recent re-surveys.

## The Decline in Abundance of Fishes at Pauoa

A similar, but slightly more pronounced downward trend was apparent at Pauoa. At this location, fish abundances declined between 49 and 76%. Of the top 35 most abundant fish species at Pauoa, again, 31 declined in abundance, ranging from 6% for the Bird Wrasse to 100% decline of the Threespot Chromis. The fishes that increased in abundance at Pauoa were two species of small damselfish, the Yellow Tang, and the Bullethead Parrotfish.

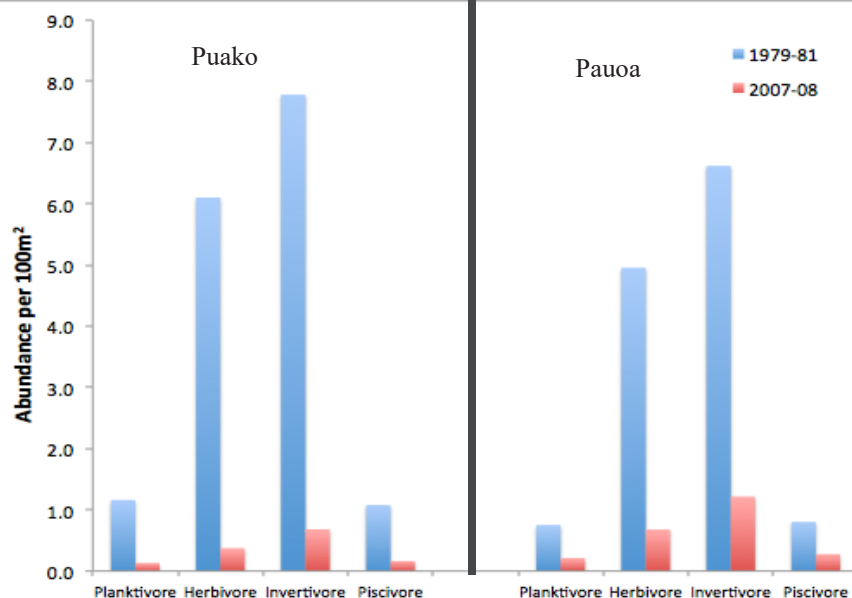
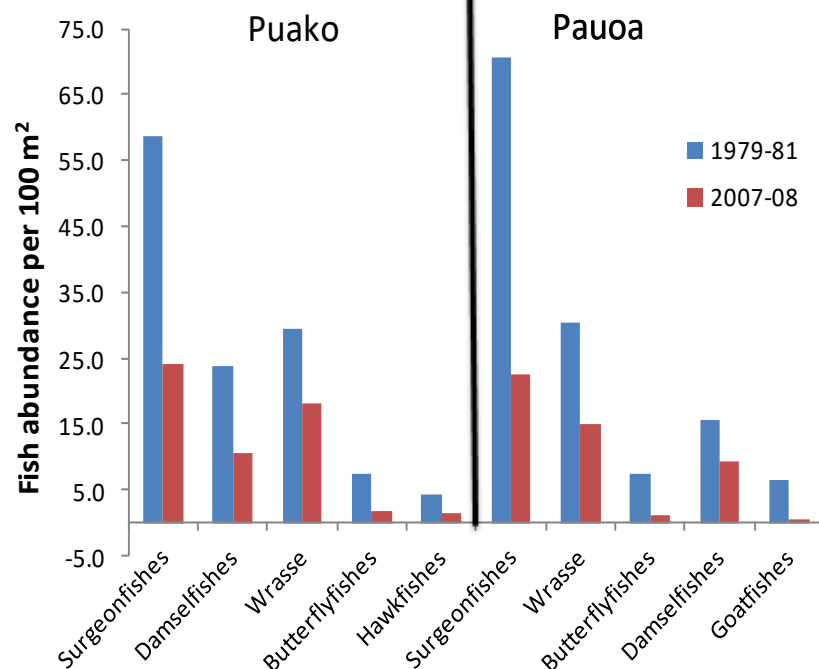
Pauoa, South Kohala, Long Term Study  
Total Fish Abundance



Total abundance of fishes per hundred meters squared in six different habitat types at Pauoa. Blue bars represent data from the original study, red bars represent the recent re-surveys.

## Abundance Trends by Fish Family

We compared the top five most abundant fish families in the original study to see if we could detect any differences in abundance trends over time at the two sites. All families decreased in abundance, ranging from 38% (wrasse at Puako) to 90% (goatfishes at Pauoa). Declines of similar magnitude occurred at both sites. Damselfishes, which are not a targeted fishery species, declined by 56% at Puako and 40% at Pauoa, indicating that factors other than recreational or aquarium fishing must be contributing to this long term decline in abundance.



## Abundance Trends by Trophic Group

We compared fish abundances by trophic category to see if we could detect any differences in abundance trends over time at the two sites. All trophic categories decreased in abundance, ranging from a 66% decline of piscivores at Pauoa to a 94% decrease in herbivores at Pauoa. Again, abundance decreases occurred across all categories of fishes.

## Trends in Benthic Percent Cover

Finally, we compared percent cover of the benthos over time for the two sites. Coral cover and crustose coralline algae cover decreased at both sites, and turf and macroalgal cover increased. Coral cover decreased by 35% at Puako, and 21% at Pauoa, while crustose coralline algae decreased by 64% at Puako, and 87% at Pauoa. Turf and macroalgal cover increased by 38% at Puako, and 322% at Pauoa.

